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This study was performed as an HP&R project (A-8-28) in cooperation with the Federal Highway Administration.

16. ABSTRACT

Under an HP&R research study entitled "Mitigation of Highway Related Chemical Water Quality Pollutants", Caltrans conducted a letter survey in 1978-79 of the 50 state transportation agencies to determine what mitigation measures were being used to remove chemical pollutants from various sources such as hazardous spills, constituents in pavement runoff water, leachates from mineral bearing soils, sandblasting old paint from bridges, etc. Sediment derived from slope erosion and deicing salt was excluded from the survey although several states provided information on this.

Responses were received from each of the states with varying amounts of information. Several states provided plans and specifications for special treatment measures that they used at a particular location. Most of the measures were site specific. Studies to identify the chemical nature of roadway-related pollutants are being conducted in a number of states. A few states indicated that no mitigation was being done primarily because no pollutant problems have been identified.

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STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
OFFICE OF TRANSPORTATION LABORATORY

January 1980

FHWA No. A-8-28
TL No. 19-604165

A SURVEY OF MEASURES USED BY STATE TRANSPORTATION AGENCIES TO MITIGATE CHEMICAL WATER POLLUTANTS RELATED TO HIGHWAY FACILITIES

Study Made by ..... Enviro-Chemical Branch

Under the Supervision of ..... Earl Shirley, P.E.

Principal Investigator ..... Richard B. Howell, P.E.

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ACKNOWLEDGEMENTS

This report was prepared by the Water Quality and Solid Waste Research and Development Section of TransLab under the direction of Richard B. Howell. The assistance of Don I. Nakao and Douglas M. Parks on the research project is appreciated.

The report evolved from the encouragement of Byron Lord of the Federal Highway Administration's Office of Research who felt the information from the survey would be of value to all the states as they develop best management practices for coping with transportation related water pollutants. Most states indicated in their letter responses a desire to receive a copy of the compiled results which confirmed the anticipated interest.

Appreciation is expressed to each of the state transportation agencies participating in the survey and particularly those individuals who took the time from their busy schedules to provide as much detailed information as possible. Without the cooperation of the other states, the information contained in this report would not have been possible.

The review and commentary by Earl Shirley of TransLab and Byron Lord of FHWA are sincerely appreciated. Acknowledgement is given to Darla Bailey who typed the report.

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CONVERSION FACTORS

English to Metric System (SI) of Measurement

Quanity	English unit	Multiply by	To get metric equivalent
Length	inches (in)or(")	25.40	millimetres (mm)
		.02540	metres (m)
	feet (ft)or(')	.3048	metres (m)
	miles (mi)	1.609	kilometres (km)
Area	square inches (in^2)	6.432×10^{-4}	square metres (m^2)
	square feet (ft^2)	.09290	square metres (m^2)
	acres	.4047	hectares (ha)
Volume	gallons (gal)	3.785	litres (l)
	cubic feet (ft^3)	.02832	cubic metres (m^3)
	cubic yards (yd^3)	.7646	cubic metres (m^3)
Volume/Time			
(Flow)	cubic feet per second (ft^3/s)	28.317	litres per second (l/s)
	gallons per minute (gal/min)	.06309	litres per second (l/s)
Mass	pounds (lb)	.4536	kilograms (kg)
Velocity	miles per hour(mph)	.4470	metres per second (m/s)
	feet per second(fps)	.3048	metres per second (m/s)
Acceleration	feet per second squared (ft/s^2)	.3048	metres per second squared (m/s^2)
	acceleration due to force of gravity(G)	9.807	metres per second squared (m/s^2)
Weight Density	pounds per cubic (lb/ft^3)	16.02	kilograms per cubic metre (kg/m^2)
Force	pounds (lbs)	4.448	newtons(N)
	kips (1000 lbs)	4.448	newtons (N)
Thermal Energy	British thermal unit (BTU)	1055	joules (J)
Mechanical Energy	foot-pounds(ft-lb)	1.356	joules (J)
	foot-kips (ft-k)	1.356	joules (J)
Bending Moment or Torque	inch-pounds(ft-lbs)	.1130	newton-metres (Nm)
	foot-pounds(ft-lbs)	1.356	newton-metres (Nm)
Pressure	pounds per square inch (psi)	6895	pascals (Pa)
	pounds per square foot (psf)	47.88	pascals (Pa)
Stress Intensity	kips per square inch square root inch (ksi $\sqrt{in}$)	1.0988	mega pascals $\sqrt{metre}$ (MPa $\sqrt{m}$)
	pounds per square inch square root inch (psi $\sqrt{in}$)	1.0988	kilo pascals $\sqrt{metre}$ (KPa $\sqrt{m}$)
Plane Angle	degrees (°)	0.0175	radians (rad)
Temperature	degrees fahrenheit (F)	$\frac{tF - 32}{1.8} = tC$	degrees celsius (°C)

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	i
INTRODUCTION	1
FINDINGS	3
CONCLUSION	7
IMPLEMENTATION	8
SUMMARY OF STATE TRANSPORTATION AGENCY RESPONSES	9
REFERENCES	49
APPENDIX	53
Survey Letter	54
List of Transportation Agencies	56

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FIGURES

No.	Title	Page
1	Filter Box	13
2	Sedimentation Basin With Grease Trap and Sand Filter	14
3	Drainage Structure	16
4	Sedimentation Pool	17
5	Floating Silt Barriers	19
6	Riprap Toe Wall and Silt Barrier	20
7	Retention Basin	21
8	Retention Basin	22
9	Hydrated Lime Treatment Option	29
10	Caustic Soda Treatment Option	30
11	General Plan of Site (Settling and Skimming Chamber)	32
12	General Plan of Structure	33
13	Retention Pond	34
14	Filter Drain	38
15	Ecological Recharge Basin	41

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INTRODUCTION

Since the passage of the National Environmental Policy Act of 1969, highway agencies have identified various potential environmental impacts for proposed transportation projects. This report focuses on measures actually used by these agencies to mitigate certain of these potential impacts. The report specifically addresses impacts on the chemical quality of water resulting from such things as hazardous spills, pavement runoff constituents, and leachates from exposed slope material or construction material. Erosion control and chemical deicing compounds are not addressed.

Many of the methods that are used to identify and quantify various transportation related impacts to the water environment have been developed in the last decade. The Federal Highway Administration has been instrumental in preparing manuals and presenting workshops to assist the various state transportation agencies in this regard(1). Approximately 31 states, the District of Columbia, and Puerto Rico have had the one-week Water Quality Workshop sponsored by the National Highway Institute.

For many of the potential chemical impacts, measures can be used to reduce the effect of the impact on the water environment. For others, measures need to be developed to provide for reasonable and economical mitigation of adverse effects. Many measures are being studied by transportation agencies and research organizations.

To further the use of such measures in California, Caltrans initiated an HP&R study in 1978 to examine the availability and utilization of these various mitigation measures. As

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part of this study, a survey of the 50 state transportation agencies and the District of Columbia was conducted. This report provides a summary of the responses. Where the methods used are described in a publication, the report is cited and listed in the References. Sketches and copies of plans submitted by the various agencies are included as Figures.

Portions of the information contained in this report were given at the 59th annual meeting of the Transportation Research Board in Washington, D.C.

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FINDINGS

Responses were received from 49 of the states and the District of Columbia with varying amounts of information. Several states described special treatment measures that were used at specific locations. Many of the states indicated studies were being conducted to identify nonpoint source pollutants so that they could develop effective treatment measures. A few states indicated that no mitigation was being done primarily because no pollutant problems had been identified, or if they did exist, were of low priority as compared to other pollution problems.

The pollutants and measures that were identified are listed according to the number of responses from the state transportation agencies. A discussion of each category follows:

1. Pavement Runoff (Chemical Constituents)

Eighteen states reported a concern with chemical constituents in pavement runoff water and many of these were making or have undertaken a study in this area. The identification of roadway pollutants appears to be the main emphasis of these studies. Measures to cope with problems identified in study findings were not mentioned.

2. Detention Ponds/Sediment Basins

Sixteen states discussed variations of detention ponds and sediment basins to hold runoff water. In some cases, the basins were for settling sediment particles. Other uses included infiltration, removal of chemicals, and diversion structures.

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3. Hazardous Spill Programs

Fifteen states mentioned hazardous material spill and abatement programs. The methods used generally were directed at containment of the spill, notification of safety authorities, including identification of the material, and cleanup. Safety improvements were identified as a preventative measure.

4. Leachates From Mineralized and Problem pH Soils

Eleven states indicated a concern with leachates in exposed mineral bearing material and acid/alkaline soils. The methods used to eliminate the chemical leachate included covering it with top soil, burying the material within embankment sections, and removing adverse material with disposal at an approved site. If the material had an economic value, such as coal, the contractor was allowed to mine it.

5. Drainage Diversion

Ten states described diversion techniques to pass drainage water around sensitive water receptors to maintain the quality of the existing water resource. Two states mentioned projects where the highway alignment was moved to prevent contact with the water.

6. Vegetated Waterways

Seven states reported the use of grassed waterways and vegetation barriers to trap and filter pollutants in runoff water. Studies conducted by two states showed this to be an effective method for improving water quality.

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7. Detention Structures With Baffles, Skimmers, Filters

Six states described the use of detention structures with various baffles, skimmers, traps or filters to remove oil and grease, floatable material, nutrients and sediment particles resulting from runoff from the traveled way.

8. Sandblasting Debris in Bridge Repainting

Three states discussed concern with lead and other material produced during sandblasting operations to prepare steel bridges for repainting. Shrouding systems consisting of net curtains were used by two states to trap materials. One state had specifications for the use of clean sand as the material for sandblasting.

9. Mechanical Water Treatment Plants

Two states reported using mechanical water treatment plants to separate and remove pollutants from pavement runoff and slope drainage. One plant was used to remove aluminum from seeps within the highway right-of-way. The other treatment plant removed oil and grease, floatables, nutrients and sediment.

10. Leachates From Solid Waste

Two states discussed leachates from solid waste material disposed within the project. The principles of land fill operations, such as spreading soil lifts over waste layers and compacting, were used to prevent groundwater contamination.

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11. Cofferdams and Dewatering Pollutant Controls

Two states mentioned the use of cofferdams around piers and pilings with pollutant control of dewatering operations wherein the water is piped to onshore ponds for settling of solids.

12. Miscellaneous

Other methods mentioned included: monitoring for leaks of fuel storage tanks, specifying the storage and use of chemicals, statewide planning to assist industry in recycling material to minimize potential hazardous cargo spills, training in water quality and pollution control technology, testing of monitoring water, street sweeping to remove particles along roadways, and undertaking comprehensive environmental investigations to identify possible pollutant problems.

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CONCLUSION

Most state highway agencies are addressing nonpoint source pollution problems related to water quality. The measures vary with the main emphasis on using detention or sediment basins. Hazardous material spill programs were also mentioned as a major effort to protect the quality of the state's water resources.

There appears to be a significant need to develop and evaluate water pollution control abatement alternatives for a number of potential transportation related pollutants such as oil and grease, toxic metals, nutrients, and solids. These measures could be incorporated into the Best Management Practices for each state under Section 208 of Public Law 92-500, the Federal Water Pollution Control Act Amendments.

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IMPLEMENTATION

Copies of this interim report will be distributed to the various Caltrans' Headquarters Offices and 11 Transportation Districts, and to the Federal Highway Administration for distribution within their organization. A copy will be sent to each of the state transportation agencies that responded to the survey and requested a copy.

Measures discussed in this study will be evaluated for use within Caltrans by the various functional units and Trans-Lab. Many of the measures, or modifications of them, are already being used. Studies will be undertaken at appropriate times to investigate additional measures that show promise for reducing chemical impacts to water quality from transportation facilities.

The research study under which this interim report was prepared will continue with the investigation of two specific mitigation measures: 1) Use of detention basins to trap chemical pollutants contained in roadway runoff, and 2) evaluation of alternative measures to mitigate leachates from road slopes.

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SUMMARY OF STATE TRANSPORTATION AGENCY RESPONSES

In December of 1978, a letter was sent to the 50 state highway and transportation agencies and to the District of Columbia requesting information on methods used to mitigate potential water quality impacts related to highways. A copy of the survey letter is shown in the Appendix.

The letter asked the agencies to specifically identify those measures used to mitigate chemically-related impacts from items such as constituents in pavement runoff, hazardous spills, leachates from exposed minerals or other material in road slopes, and other chemicals associated with the roadway operation. The effects of deicing salts and mitigation measures are not addressed in this study because of other more comprehensive investigations on this subject. Erosion and sediment are not included either because of the extensive amount of work that has been and is currently being conducted in this area. The reader is referred to reports in the literature for information on deicing salts and erosion control.

The following information presents a summary of the responses from the 50 states and District of Columbia. It is recognized that research is ongoing in a number of areas regarding mitigation of chemical pollutants associated with roadways. A list of agency respondents is shown in the Appendix.

Because of limitations in time and manpower, some states were not able to provide detailed responses to the December 1978 letter survey. It should be recognized that the

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information listed under each state may only represent a general indication of mitigation measures that are used. A more detailed review of specific measures used in each state is beyond the scope of this project.

Caltrans appreciates the cooperation received from the various state transportation agencies. It is hoped that the information contained in this report will be of help to the states in the continuing development of water pollution control technology for transportation systems.

A summary of the state responses follows:

Alabama

- °Containment and cleanup of hazardous material spills is performed by maintenance crews in cooperation with the State of Alabama Health Department. In some cases, a temporary dam was constructed to contain spills of certain materials on the roadway.

Alaska

- °Although water quality conditions are excellent, no known methods for controlling water-borne pollutants from roadways have been utilized due to low traffic volumes. The use of deicing chemicals is very low.

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Arizona

- A hazardous cargo system is practiced by the maintenance section. The hazardous cargo booklets used by Arizona DOT are from the National Highway Traffic Safety Administration, AASHTO and FHWA(2).

- No other problems relating to water quality have been experienced.

Arkansas

- The department proposed a project in the northwest portion of the state which would cross an environmentally sensitive area. Extensive studies were made of the area to identify the probable impacts of the proposed facility and possible mitigation of the impacts. Designs were studied that would isolate drainage from the roadway from that of the surrounding land. The separate roadway drainage system included detention basins to allow for removal of pollutants. After evaluation of the available alternates, it was decided to relocate the facility outside of the environmentally sensitive area(3).

California

- The department maintains a hazardous spill cleanup program under the direction of the Office of Maintenance(4). When the spill involves a potential contamination of water, the Department of Health Services, Department of Fish and Game and Regional Water Quality Control Boards are consulted.

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°The Office of Maintenance undertakes a street sweeping and litter cleanup program(5). This minimizes a potential source of water pollutants.

°The Transportation Laboratory is engaged in a number of research investigations to identify roadway runoff pollutants and its effects on receiving water(6). Studies continue on the use of basins to trap various chemical pollutants, shrouding to minimize particulates from sandblasting lead-based paints on bridges(7), leachates from decaying vegetal matter in embankments(5), and problem soil or mineral leachates from exposed material in road slopes.

°Environmental investigations for proposed projects include a detailed water quality study if necessary. Water testing is performed where data are lacking and, in some cases, bioassay tests are conducted using fish to identify toxicity potentials of proposed construction materials. If the material is found to have a toxic leachate, it is not allowed for use in construction unless treated or placed so that it will not leach. Standard Specifications (Sec. 7-1.01L) are enforced on construction projects to prevent water pollution.

°One transportation district has used five different systems within the last five years. They are as follows: 1) a filter box (see Fig. 1), 2) a grease trap, 3) a sedimentation basin with grease trap and sand filter (see Fig. 2), 4) infiltration basin with modified drainage, and 5) a drainage structure consisting of a concrete box (4' x 8.5' x 5' deep) with

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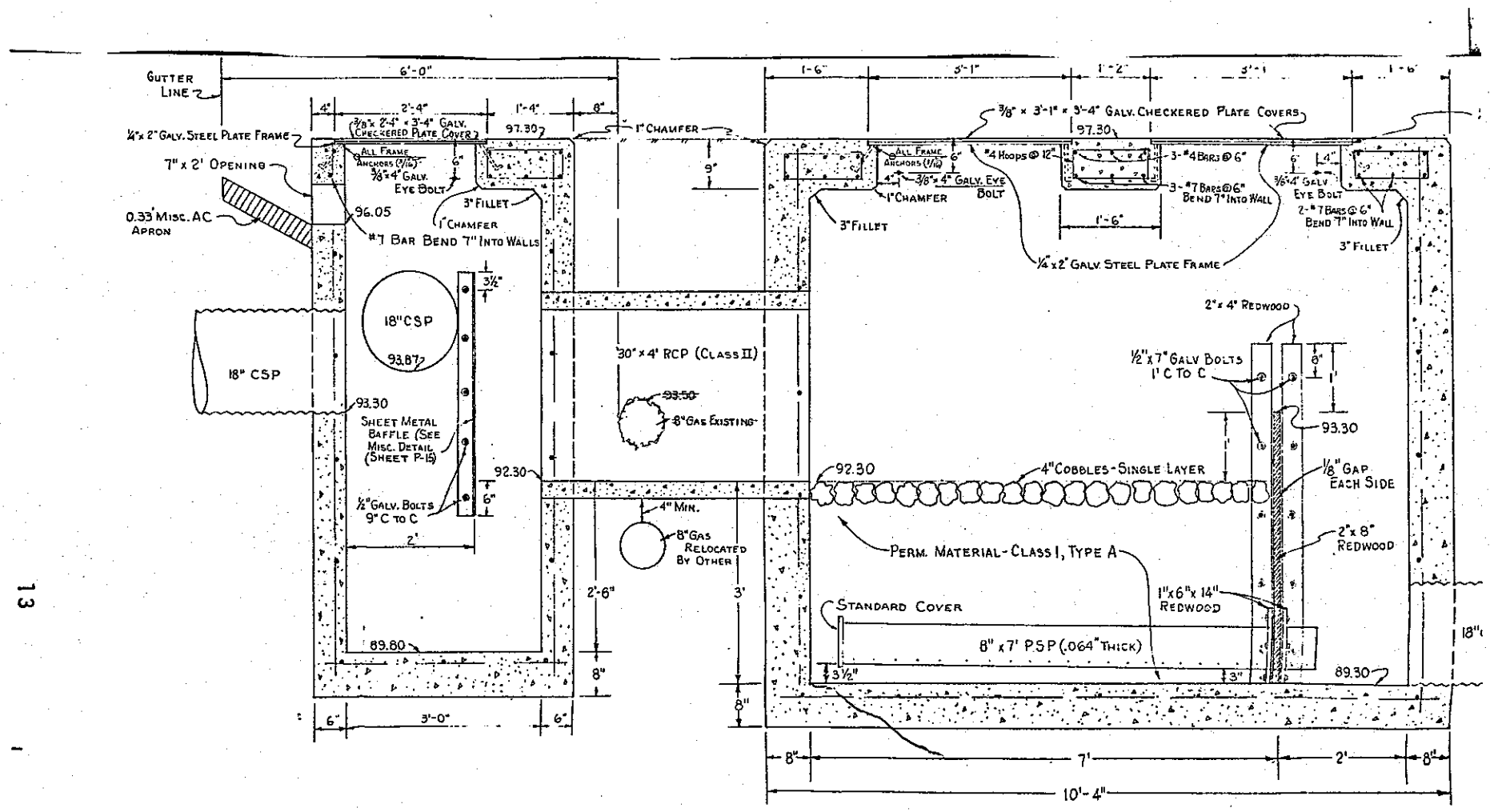

Section A-A
Scale: 1" = 1'

Filter Box

Figure 1

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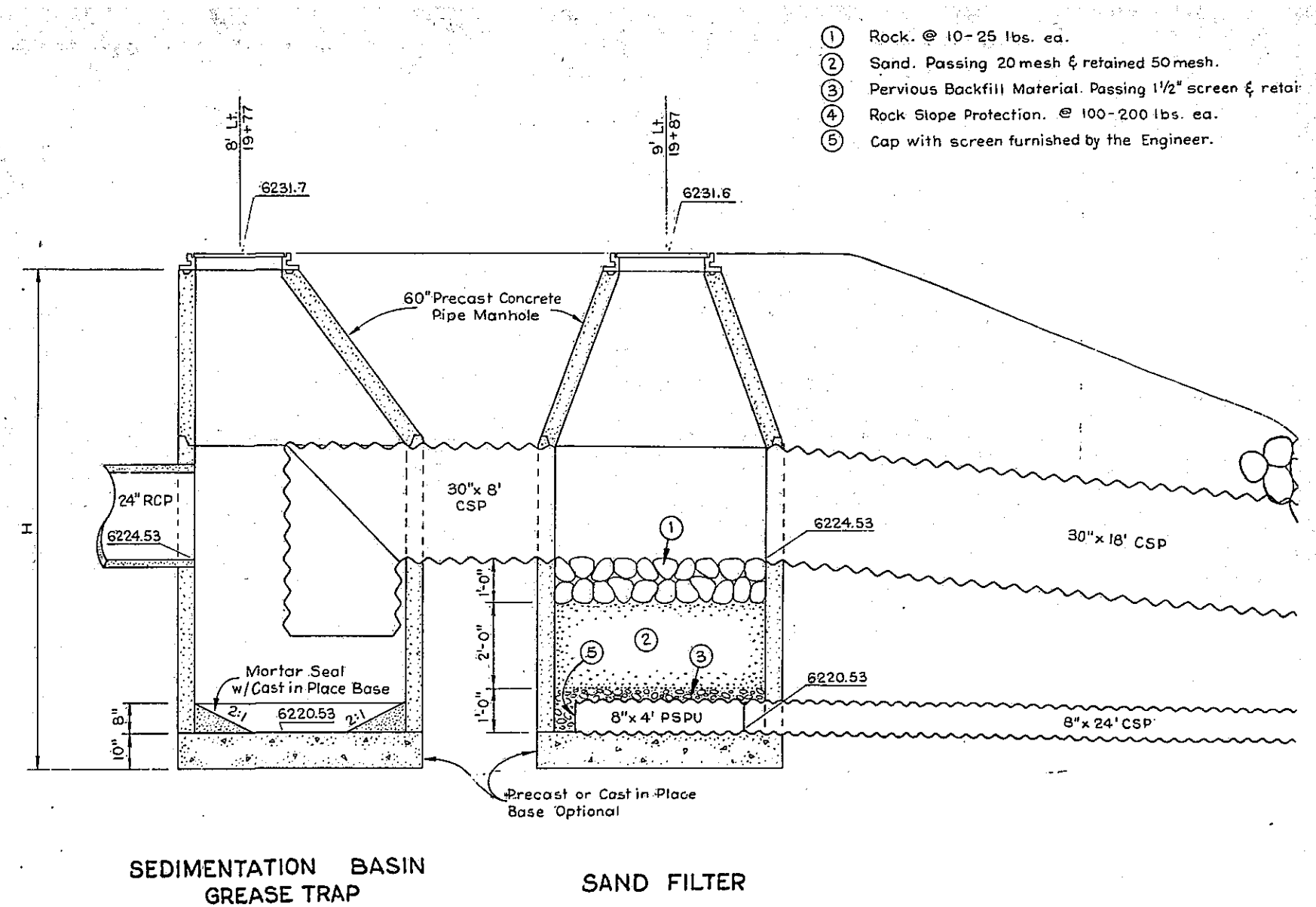

Sedimentation Basin With Grease Trap and Sand Filter

Figure 2

a baffle and a valve for controlled releases (see Fig. 3). The drainage structure is used to collect flows from a wash rack and gas and oil storage area at a maintenance station. Another district installed a sediment pond for depositing residue from a concrete pavement grinding operation. The pond was oval in shape (40' x 60').

Colorado

°The department operates under standard procedures for emergency action regarding chemical spills.

°Where culverts are proposed, evaluation of soils for alkaline or acidic conditions are undertaken.

Connecticut

°The department investigated the use of vegetative barriers to restrict the outward movement of lead from pavement runoff(8).

°The department is conducting an HP&R research study on "Evaluation of Sedimentation Pools Constructed on Transportation Projects". The study began in November of 1978 and will extend for two years. Figure 4 shows a typical plan and sectional view of a sedimentation pool.

°A study is also underway at the University of Connecticut on chemical reactivity of selected strata in Connecticut which is used as a construction material.

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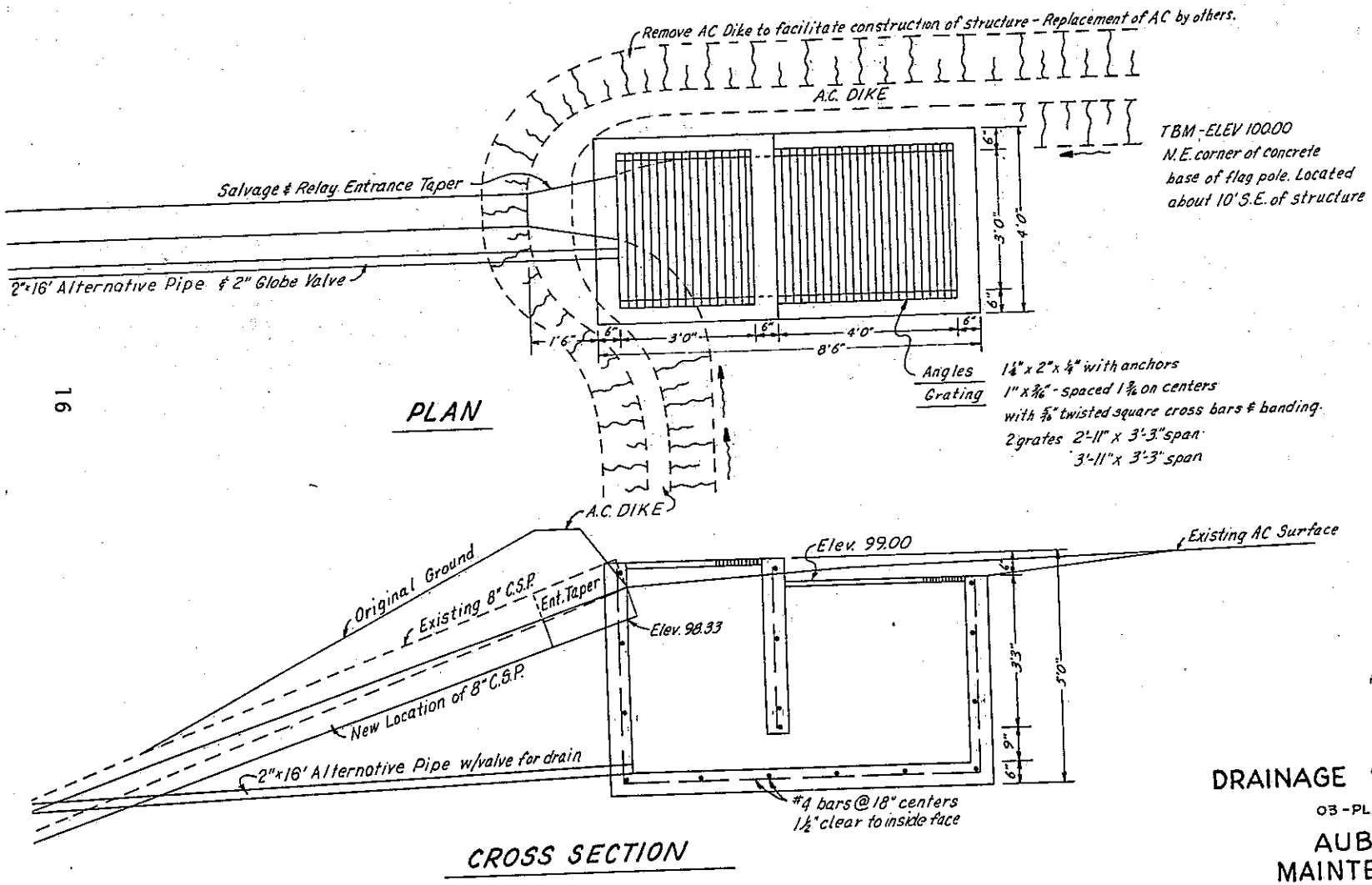

Figure 3

DRAINAGE STRUCTURE

03-PLA-5701

AUBURN
MAINTENANCE
STATION

SCALE: ½" = 1'0" SHEET 3 OF 3

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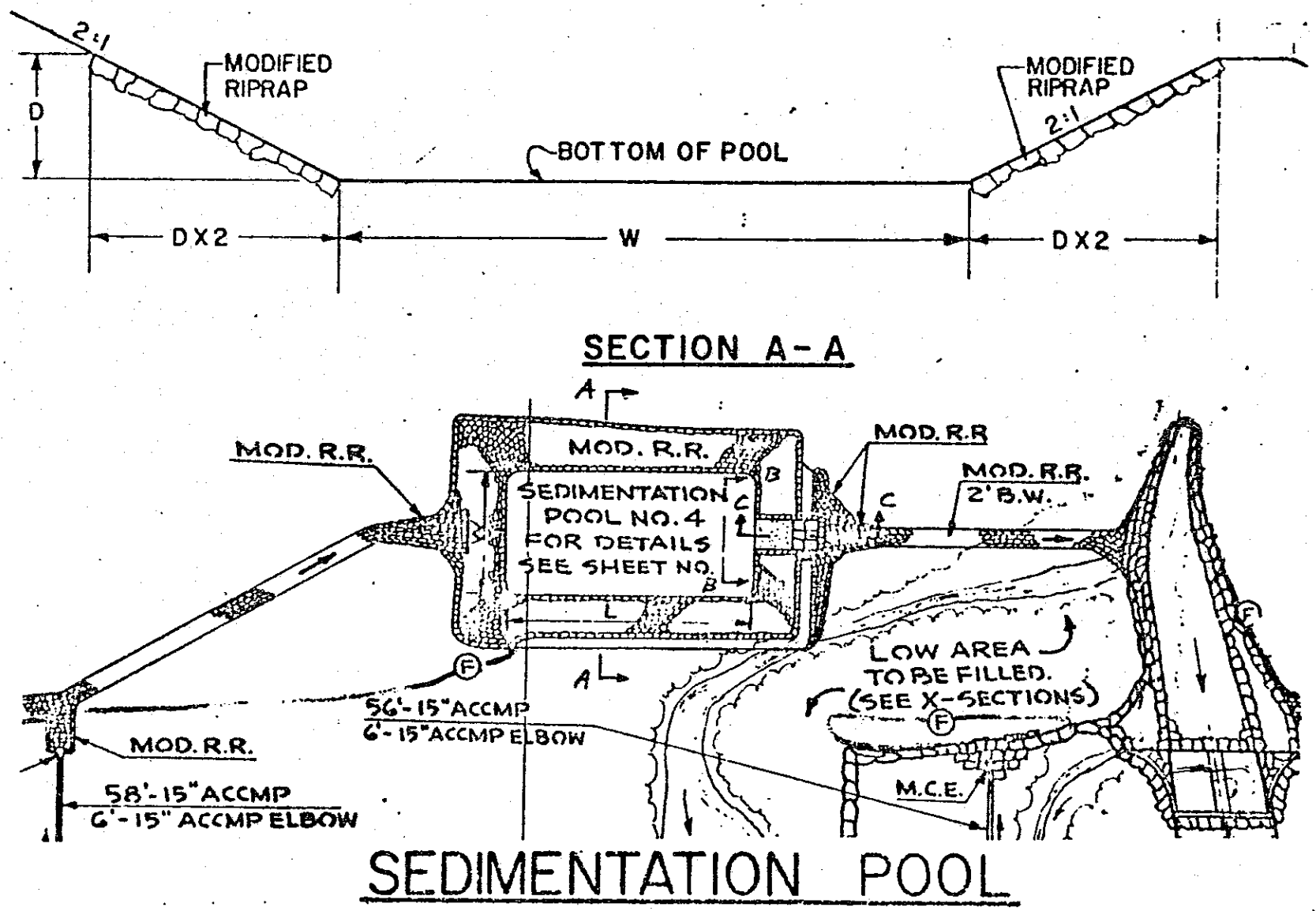

FIGURE 1 - Plan and Sectional View of Typical Sedimentation Pool. (ConnDOT Drainage Manual)

Figure 4

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Delaware

°No methods were reported.

District of Columbia

°To date there have been minimal difficulties with adverse impacts on water from transportation sources. The department has found that standard grease traps have rectified their problems.

Florida

°The department has a Standard Specification (Section 104) to enforce erosion and water pollution control during construction. Figures 5, 6, 7 and 8 show devices in their water quality control plans.

°The U.S. Geological Survey has studied the quality of water from roadway runoff into borrow ponds(9). A research study with the Federal Highway Administration will monitor pavement runoff constituents at Orlando.

°Environmental studies regarding water quality are conducted for proposed projects. For one project at Lake Jackson, a sediment filter cloth referred to as the "Big Diaper" was used to redirect sediment deposits to less sensitive areas of the lake(10).

°A study was conducted to assess the use of shallow-water roadside ditches for stormwater purification(11).

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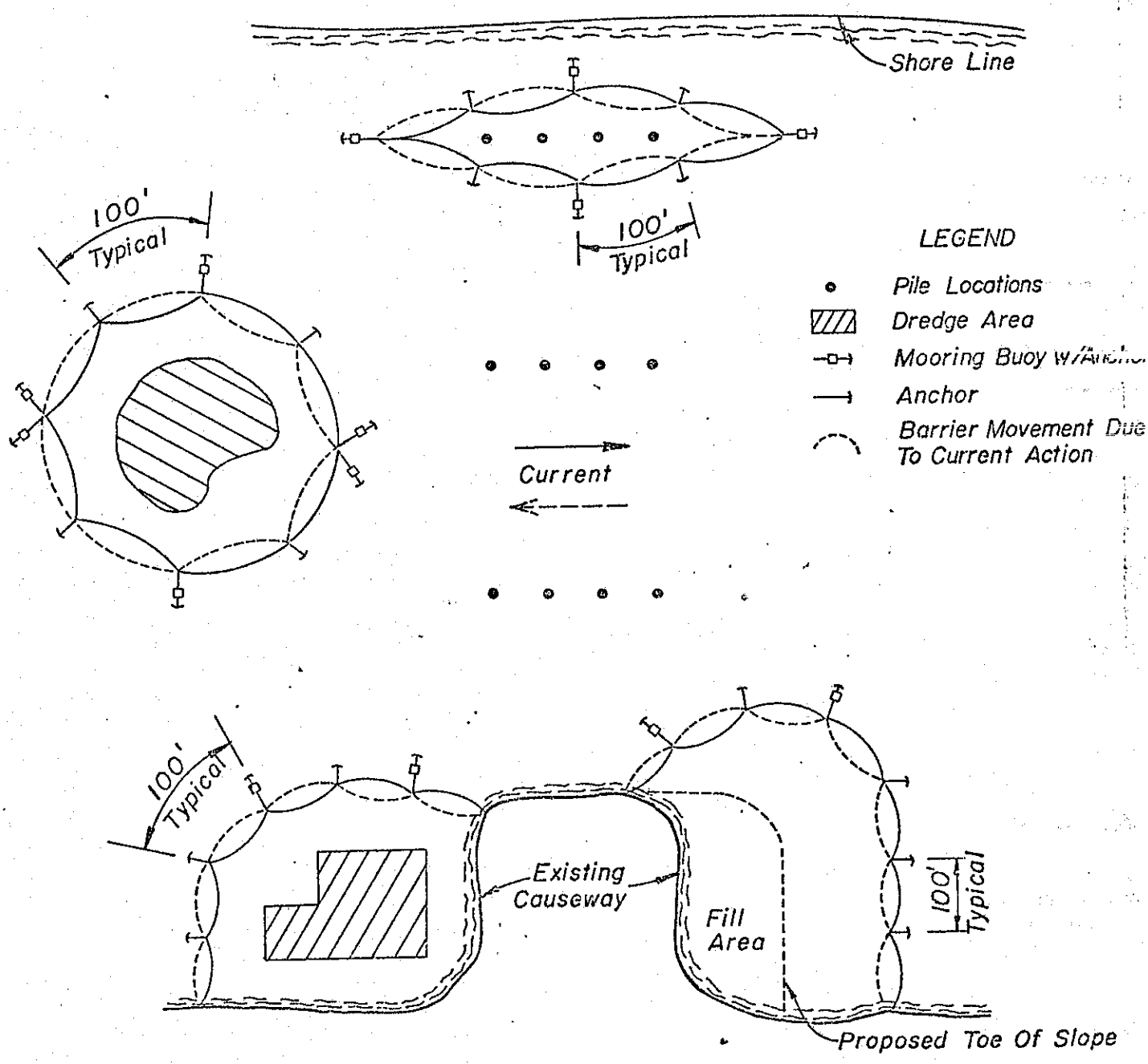
WATER QUALITY CONTROL
TYPICAL APPLICATIONS FOR FLOATING SILT BARRIERS



Notes:

1. Number and spacing of anchors dependent on current velocities.
2. Deployment of barrier around pile locations may vary to accomodate construction operations.
3. Navigation may require segmenting barrier during construction operations.
4. The above applications indicate Type I Floating Silt Barrier since anchors are shown, however if conditions warrent, Type II Floating Silt Barrier may be used. For additional information see specifications and applications.

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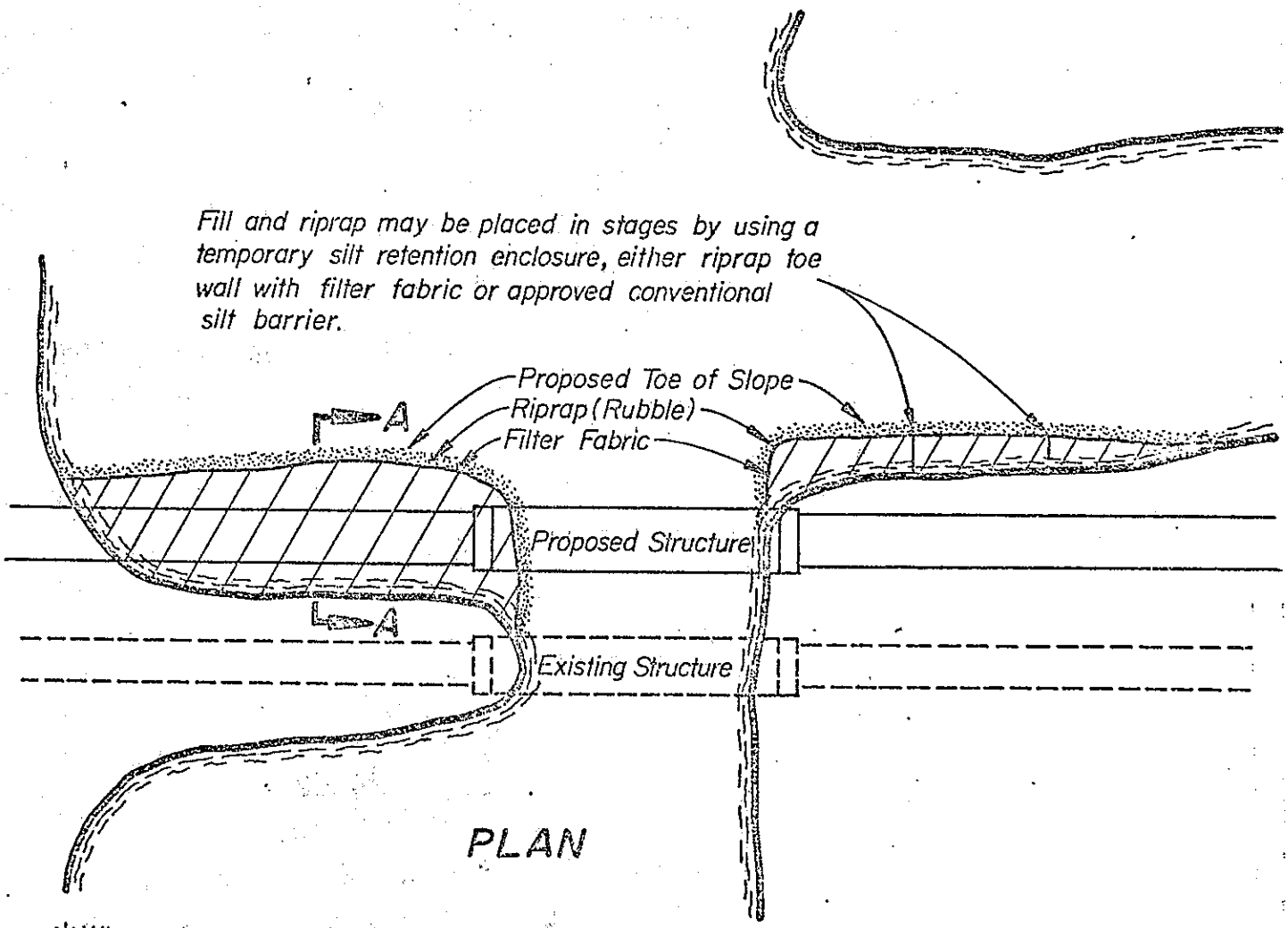
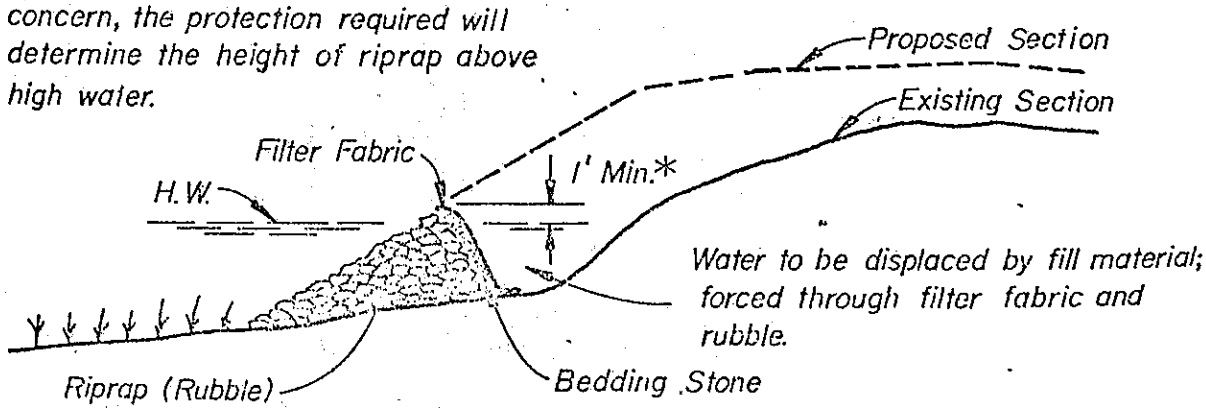
Figure 6

WATER QUALITY CONTROL
RIPRAP TOE WALL & SILT BARRIER



*Where shore protection is the primary concern, the protection required will determine the height of riprap above high water.



SECTION 'AA'

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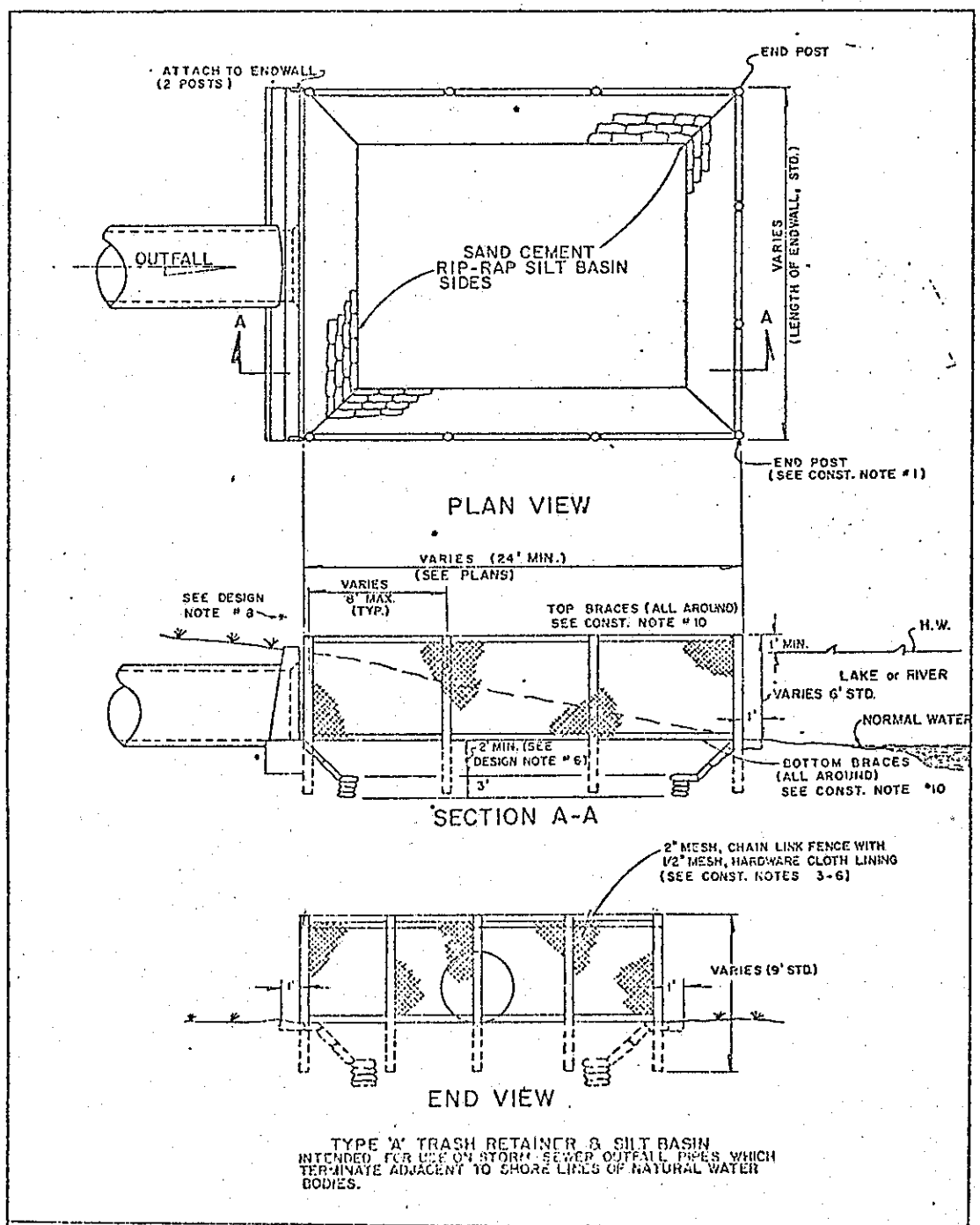
WATER QUALITY TREATMENT RETENTION BASIN



TYPE 'A' TRASH RETAINER & SILT BASIN
INTENDED FOR USE ON STORM SEWER OUTFALL PIPES WHICH TERMINATE ADJACENT TO SHORE LINES OF NATURAL WATER BODIES.

GENERAL DESIGN NOTES TYPE A & B

1. THE TYPE 'B' RETAINER & BASIN IS PREFERED OVER THE TYPE 'A' BECAUSE OF THE OIL BAFFLE & A LARGER SILT BASIN. THE TYPE 'A' RETAINER SHOULD BE USED ONLY IN CASES WHERE IT IS NOT PRACTICAL TO CONST. AN OPEN DITCH BETWEEN THE ENDWALL & THE WATER.
2. THE CHAIN LINK FENCE & HARDWARE CLOTH IS INTENDED TO SCREEN OUT & RETAIN OBJECTS WASHED INTO STORM SEWER SYSTEM FOR LATER REMOVAL BY MAINTENANCE FORCES.
3. THE SILT BASIN IS INTENDED TO ALLOW SILT & SAND WASHED INTO STORM SEWER SYSTEM TO SETTLE OUT BEFORE SPILLING INTO NATURAL WATER BODY.
4. THE OIL SKIMMING BAFFLE IN TYPE 'B' RETAINER IS INTENDED TO PREVENT ANY OILS WASHED INTO STORM SEWER SYSTEM FROM SPILLING OVER WEIR.
5. THE WEIR IN TYPE 'B' RETAINER SHOULD BE LOCATED AS FAR FROM THE ENDWALL AS PRACTICAL. ON STEEP DITCH GRADES TWO OR MORE WEIRS MAY BE REQUIRED.
6. THE DEPTH OF THE SILT BASIN SHOULD BE AS DEEP AS PRACTICAL WITH A MINIMUM OF 2.0 FT.
7. THE SILT BASIN IN TYPE 'A' RETAINER CAN BE EXTENDED BEYOND THE LIMITS OF THE FENCE IF REQUIRED. IN THESE INSTANCES, FENCE WILL EXTEND DOWN TO BOTTOM OF BASIN.
8. WHERE TOP OF ENDWALL IS BELOW HIGH WATER (H.W.), FENCE WILL BE REQUIRED ALONG ENDWALL TO ENCLOSE BASIN.
9. 6" CAP IS MINIMUM DRAINAGE UNLESS SHOWN OTHERWISE IN PLANS.

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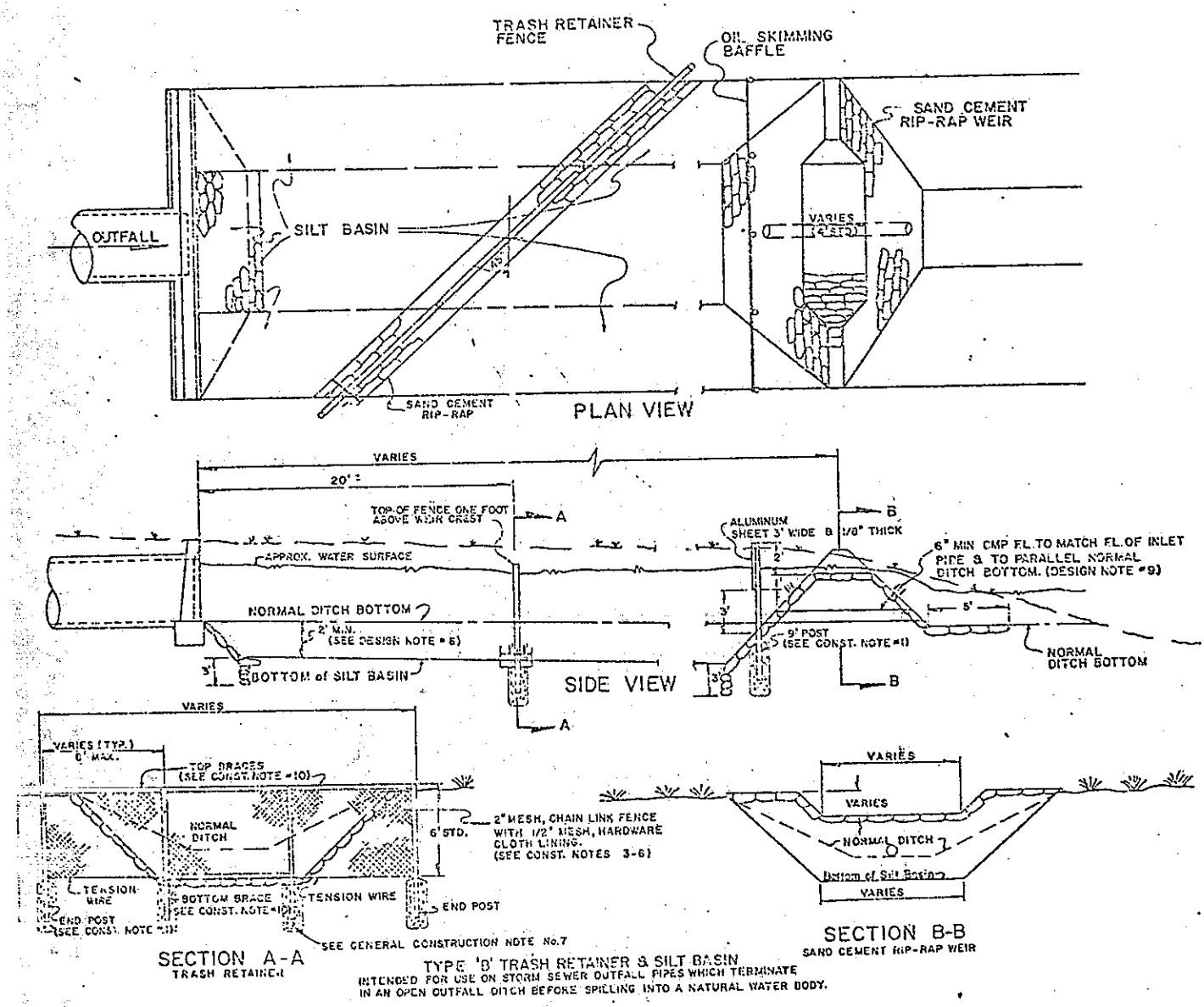
Figure 8

WATER QUALITY TREATMENT RETENTION BASIN



TYPE 'B' TRASH RETAINER & SILT BASIN

INTENDED FOR USE ON STORM SEWER OUTFALL PIPES WHICH TERMINATE IN AN OPEN OUTFALL DITCH BEFORE SPILLING INTO A NATURAL WATER BODY.

GENERAL CONSTRUCTION NOTES TYPE A & B

1. FENCE POSTS TO BE ALUMINUM OR CONCRETE ONLY.
2. ALL METAL HARDWARE TO BE ALUMINUM.
3. FENCE TO BE INSTALLED TO INSIDE OF POSTS.
4. FENCE TO BE ALUMINUM CHAIN LINK FABRIC; 2" MESH.
5. FENCE TO BE TIED TO ALL POSTS & BRACES AT 6" CENTERS.
6. ALUMINUM HARDWARE CLOTH, 1/2" MESH TO BE ATTACHED TO INSIDE OF FENCE.
7. ALL POSTS TO BE SET IN CONCRETE.
8. ALUMINUM POSTS TO BE 3" DIA. MINIMUM.
9. FOR ADDITIONAL DETAILS ON FENCING, SEE INDEX Nos. FTA-01 AND FTB-01.
10. BRACES TO BE ALUMINUM OR CONCRETE ONLY.
11. ALL SLOPES TO BE 1:1.
12. THE WORDS SILT & SEDIMENT ARE INTERCHANGABLE.
13. SEDIMENT BASINS TO BE CONSTRUCTED PRIOR TO CONSTRUCTION OF PIPE OUTFALL. MAINTENANCE AND CLEAN OUT TO BE BY THE CONTRACTOR UNTIL ACCEPTANCE BY THE ENGINEER.

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Georgia

- For hazardous spills, the department handles these situations depending on the type of materials and whatever recommended methods of cleanup or neutralization exist for a specific material. The department takes whatever precautions are necessary to prevent the material from entering the surrounding environment or harming the public.

- For materials in pavement runoff water such as oil drippings or deposits from vehicles, the runoff water passes over the shoulder system and onto the grassed areas. This provides for the maximum in retention of runoff water and also affords the best possibility of absorption into the roadway embankment and drainage ditches of any pollutants leaving the roadway.

- On occasions where low pH soils are exposed, the department blankets such slopes with an adequate thickness of topsoil and specifies an adequate grass cover for protection.

Hawaii

- The department uses sediment basins during construction as a means of controlling pollutants.

Idaho

- The department enforces standard construction specifications based on FHWA guidelines. Sediment basins are commonly used to control pollutant discharges.

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Illinois

°The department has established a Hazardous Materials Section within the Division of Traffic Safety to develop procedures to meet federal standards for the transportation of hazardous materials.

°Special provisions for temporary project water pollution control are enforced on construction projects.

°There is concern for pollution of waters from deicing salt runoff. Consequently, the department takes a monthly water sample from each of 39 sampling sites on bodies of water adjacent to highways and tests for chloride content.

Indiana

°The Environmental Quality Control Department of the State Board of Health has set up a Waste Materials Catalog listing materials that are surplus and materials that are needed in an effort to assist manufacturers to recycle waste products and reduce disposal problems.

°The highway commission specifies flatter slopes and wider shoulders to improve safety and slow down runoff water or hazardous materials. Also, new procedures call for elimination of sharp curves, widening narrow bridges and removal of obstructions as an aid in reducing hazardous spills.

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Iowa

°The department has standard construction specifications covering temporary water pollution control measures.

°Procedures for the repainting of older bridge structures have been modified to protect the environment. The use of red lead base paints has been discontinued. Specifications now being prepared for the spring 1979 bridge painting contracts will require special measures to control drift of sand blast dust. Tarps or plastic will be used to catch the blast material to prevent its blowing over land or entering streams. Silica rather than naturally occurring sands will be used. Floating straw/rope dams may be used to collect surface materials which do escape to streams below bridges.

°The proposed reconstruction of U.S. Highway 71 through the Iowa Great Lakes area has presented some special water quality protection problems. One of the lakes in this area is of very high quality and is designated as a natural, blue water lake. Special settling basins designed to collect storm runoff from the roadway and allow deposit of suspended particles before admitting the water to the lake are being contemplated. Design has not progressed sufficiently to permit a detailed description of the basins or a cost estimate to be developed, however.

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Kansas

°The Construction Department follows all the pollution abatement requirements of federal agencies including OSHA requirements relating to the large fuel storage tanks for construction equipment.

°The Maintenance Department follows standard procedures for chemical spills such as blocking off the spill area and notifying the State Board of Health for special instructions.

°The Kansas Water Resources Board has made a survey of mineral springs as a source of natural pollution. These are mostly brine springs with high salt concentrations.

°The Kansas Department of Health and Environment has made studies of subsurface pollution related to leaks in large gasoline or other storage tanks at refineries and service stations. Other groundwater problems involve dissolution of underground layers of salt and gypsum.

Kentucky

°The major emphasis has been on the control of construction generated pollutants. Standard methods are used to control pollutant runoff.

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Louisiana

- The department has one project designed to mitigate the effects of pollutants in pavement runoff. The project consists of the I-220 loop around Shreveport. It traverses Cross Lake which is the city's water reservoir. To eliminate the possibility of contaminating this water by roadway runoff from the bridge, the structure was designed to contain any liquids which might accumulate on the bridge, and divert them to a detention basin. This design entailed totally sealing all bridge joints, running drain pipe the entire length of the bridge, and modifying one quadrant of the first interchange to make an impermeable detention basin. Before any water is released from the detention basin to the reservoir, it will be inspected. The project has not been built yet as of September 1979.

- The department cooperated with FHWA Office of Research as part of a nationwide study to determine constituents in pavement runoff.

- There may be some problems with sandblasting old paint from bridges. More investigations will be performed in this area.

Maine

- Most of the water quality problems are related to salt runoff. Studies are continuing in this area.

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Maryland

- The department has completed a preliminary report for a water treatment plant on U.S. Route 48 (the National Freeway) in Garrett County. The plant will serve to alleviate a dissolved aluminum problem emanating from seeps within the highway right of way (see Figures 9 and 10). The treatment plant concept resulted from discussions with the Maryland Department of Natural Resources.

- A film entitled "Road to Clean Water" was developed in cooperation with FHWA to train and inform others on erosion and water pollution control technology for highway projects.

Massachusetts

- No response to the survey was received.

Michigan

- In 1977, the Michigan Department of Transportation (MDOT) widened US-131 from two lanes to five lanes within the Village of Kalkaska. Concrete curbs and gutters were installed in conjunction with a new enclosed roadway drainage system. The drainage system outlets into a retention basin. A berm-type retention basin (115' x 35') was constructed above ground for approximately $5,000. The basin temporarily retains sediment laden runoff allowing time for suspended particles to settle out before the runoff enters the Boardman River.

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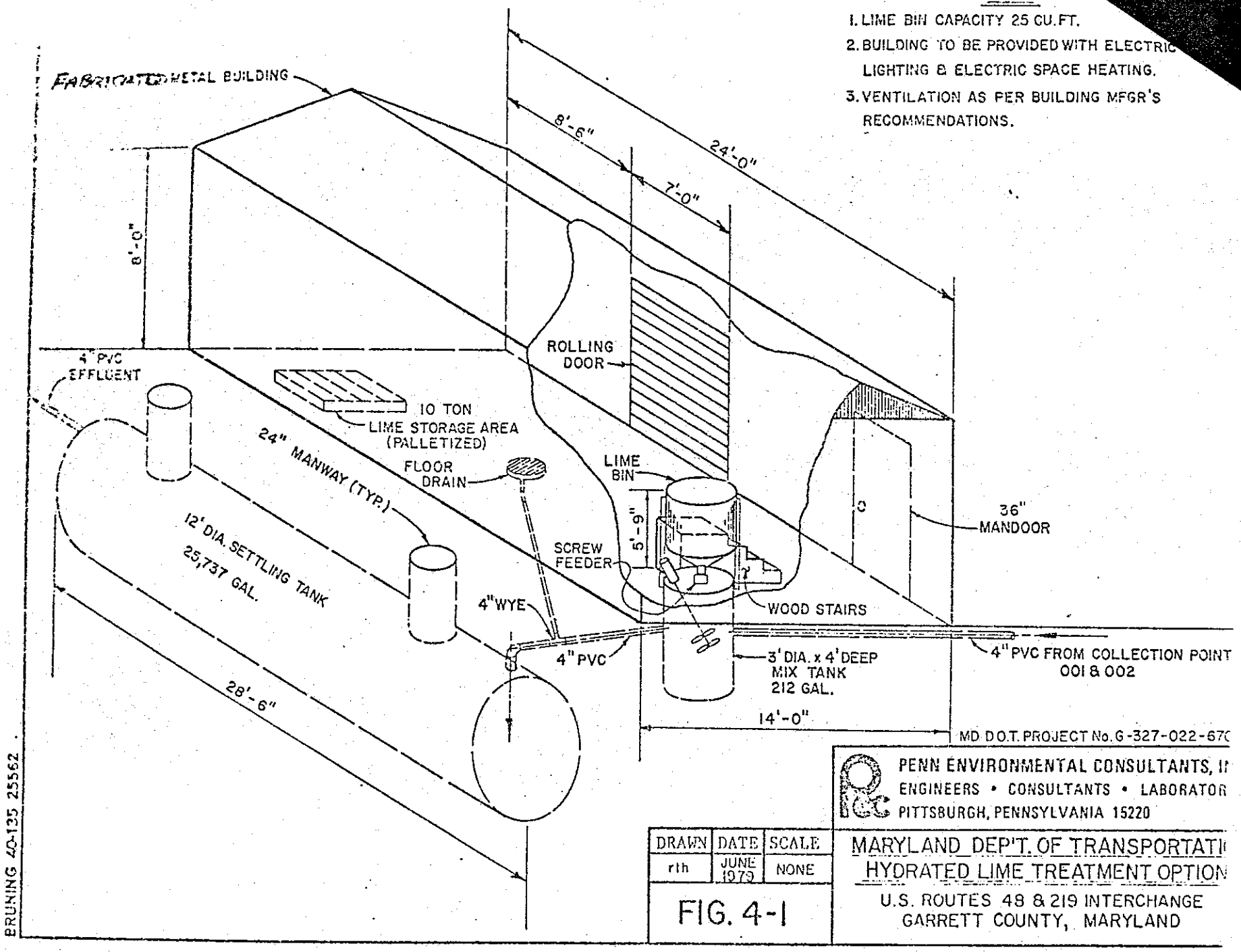
NOTES

1. LIME BIN CAPACITY 25 CU. FT.
2. BUILDING TO BE PROVIDED WITH ELECTRIC LIGHTING & ELECTRIC SPACE HEATING.
3. VENTILATION AS PER BUILDING MFGR'S RECOMMENDATIONS.



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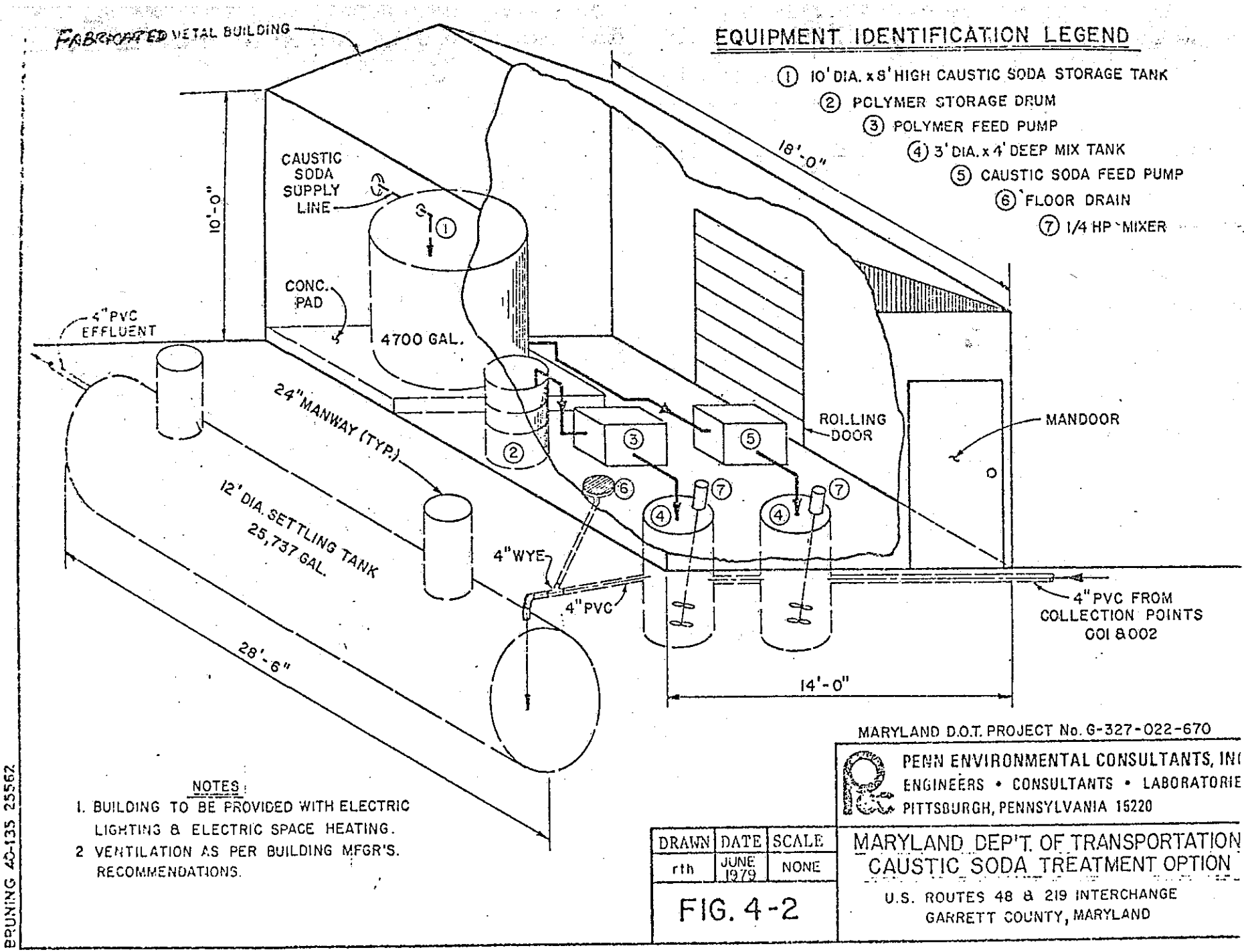

Figure 10

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Various design measures were implemented to reduce the harmful effects on the Boardman River water quality. Approximately 50 feet of existing vegetation was left between the basin and river. This allows the water exiting the basin to filter through the vegetation and deposit some of the unsettled fine particles before reaching the stream. An oil trap design is used to prevent undesirable material from leaving the basin. The outflow pipes are inverted and discharge water falls on a riprapped outlet area before flowing over the vegetation.

°On I-696, an experimental oil skimmer was constructed in conjunction with 13 miles of 102 inch storm sewer located under the freeway (see Figures 11 and 12). This was constructed at the outlet of a pump house which raises the water before it flows two more miles by gravity to outlet into Lake St. Clair. The skimmer consists of longitudinal chambers covered with open grating. In case of an oil spill on the depressed freeway, the gates at the bottom of the chamber would be manually closed, thus allowing any oil to be skimmed off the chamber when flooded. This skimmer is located at the top of the freeway cut inside the right-of-way fence(12).

°MDOT has also constructed a retention pond in the SW quadrant of the M-21/M-15 interchange on the north side of Griffin Lake (see Figure 13). This allows the majority of roadway runoff to bypass the Department-owned lake which was used for storm water storage but now has residences around it.

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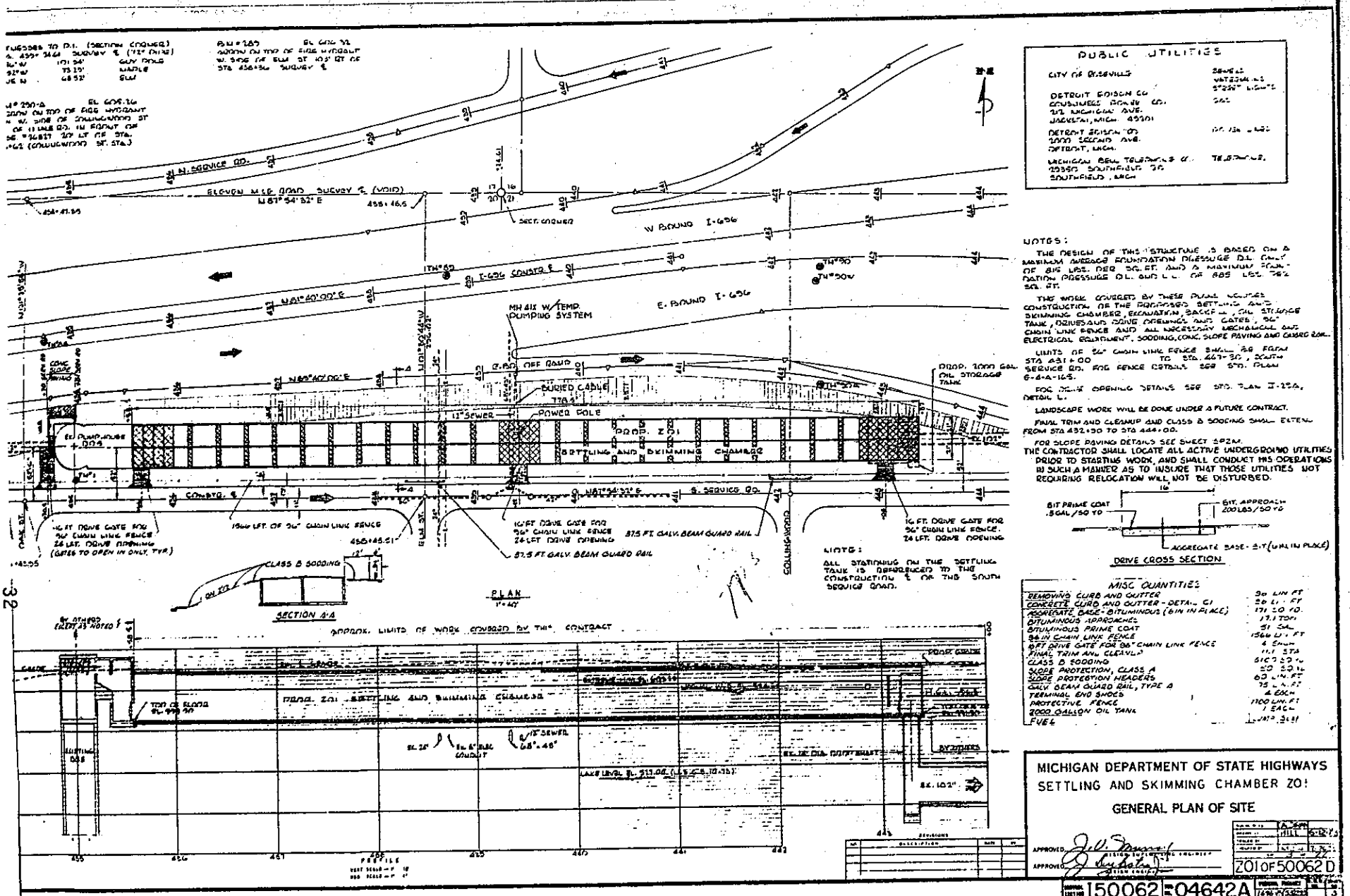

Figure 11

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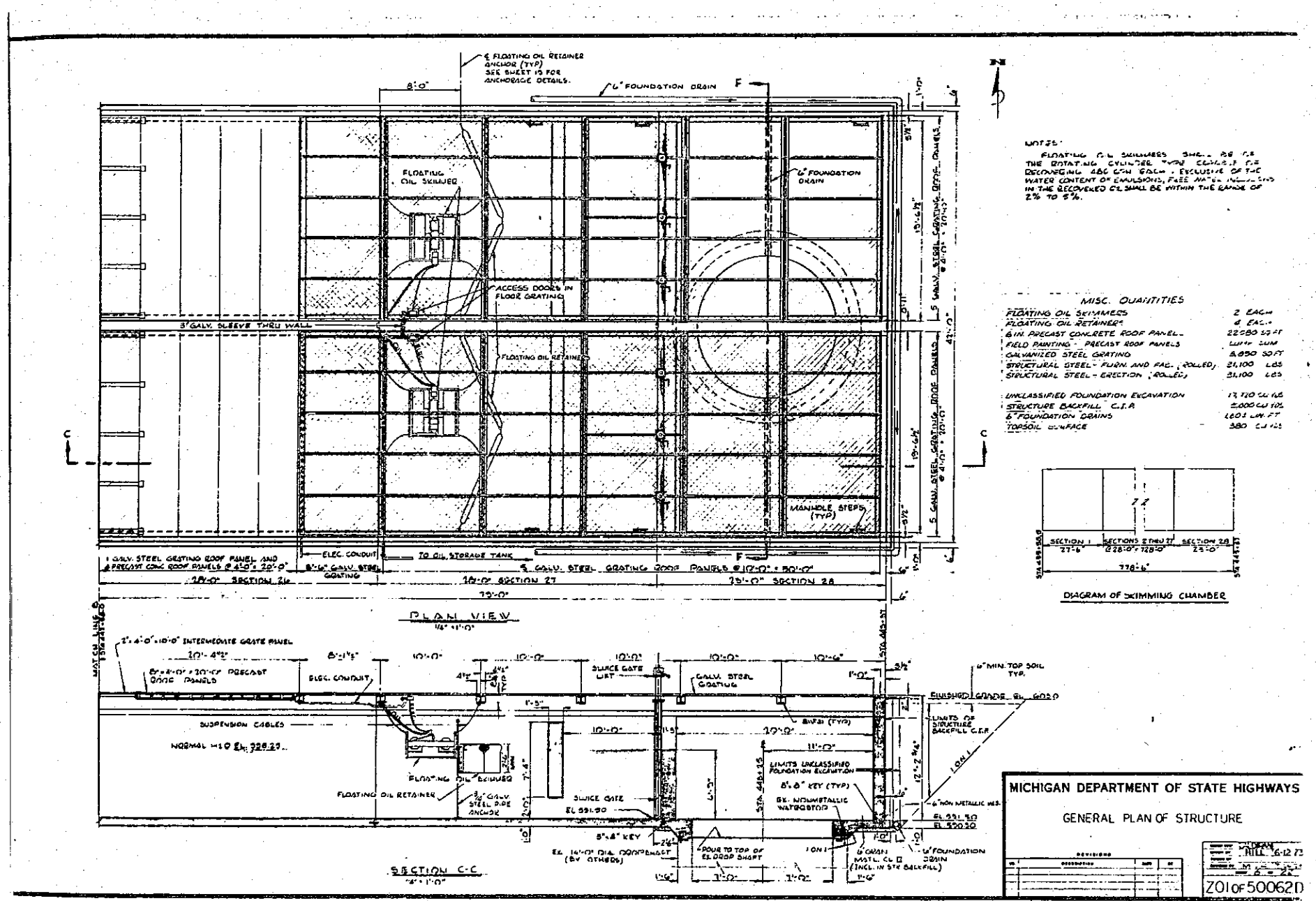

Figure 12

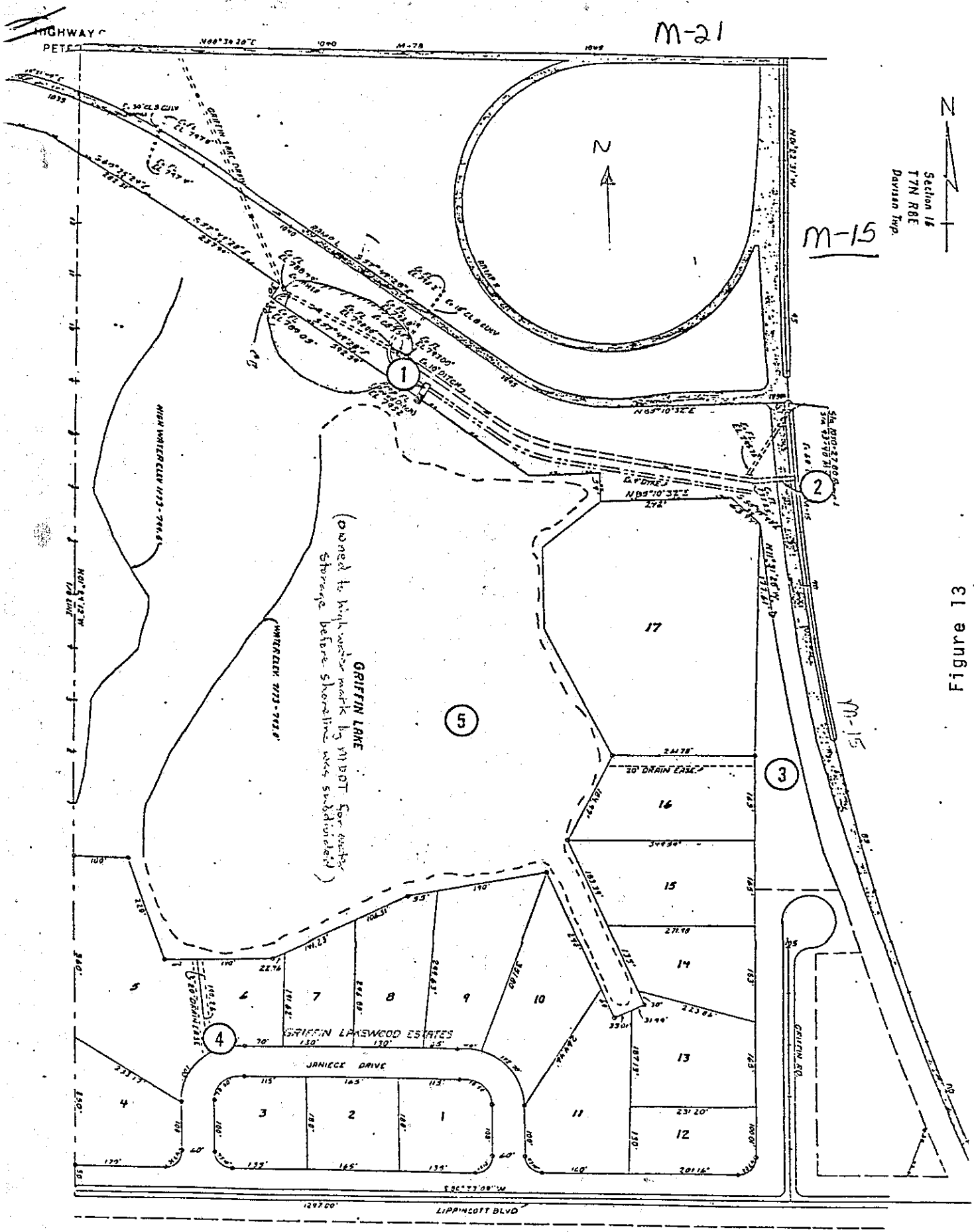

Figure 13

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- Guidelines have been developed for storing and using winter maintenance chemicals at garage sites. The guidelines have been approved by the Michigan Water Resources Commission.

Minnesota

- The department is monitoring chemical characteristics of roadway discharge after completion of projects where the Minnesota Pollution Control Agency has expressed concern.

- The primary mitigation measure at this time is sediment basins with outlet control structures. These are put in when required by local jurisdictions and periodically in other areas where land use and design coincide with sensitive receiving waters.

- There are two permanent sediment basins on a project where a bridge was constructed through a lake near St. Paul. The department is monitoring the chemical characteristics of the inflow and outflow of these basins both during the construction period and roadway operation. The object of this monitoring program is to determine the pollutant removal capability of the basins.

- The department is investigating the use of wetlands to remove pollutants from roadway runoff. A study was done on this subject for the U.S. Environmental Protection Agency and the department feels this measure deserves further investigation(13).

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Mississippi

°Where a highway project crossed the drainage patterns of small public water supply reservoirs, sediment basins with stand pipe discharges were used. The U.S. Soil Conservation Service design recommendations were used.

°Another project located in a very flat coastal area crossed the water supply canal of a paper mill. Shallow levees were shaped adjacent to the construction limits where the entrapped water was routed to acceptable discharge points.

Missouri

°The department has no new or unique methods to report at this time.

Montana

°For pavement runoff in urban sections, the department uses a curb and gutter system to direct flows. In rural areas, Fish and Game requires detention ponds before discharge in a stream. A baffle is placed across the top of the pond to remove floatable materials. Some cities are using seepage pits to infiltrate water but there is a high maintenance involved.

°A new project in design on I-15 south of Helena called Basin Boulder will go through old mine tailings. To prevent acid leachates, the design calls for burying the material within the embankment sections.

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- For the construction of bridge piers in live water, the contractor must use a cofferdam. This usually consists of interlocking sheet piling. A permit must be obtained to dewater. If the water is clean, the permit allows discharge into the river. If the water is muddy, then the discharge is to an onshore pond where the sediment is allowed to settle.

Nebraska

- Hazardous spills are handled by maintenance superintendents along with state and local law enforcement agencies.

- The department uses hay bales and earth dikes to control material in runoff water on new construction.

Nevada

- The department encountered one situation where it appeared that mitigation measures would be required to remove material in runoff water. The matter has since gone into a state of limbo for the time being. Consequently, no devices for removal of pollutants have been investigated for this project.

- The department provided information on a filter drain that consists of a steel grate inlet over three concentric reinforced concrete pipes (see Figure 14). The drainage water passes through slots to the outer pipe where it passes through a filter material before discharging. No design work has been accomplished on the hydraulics or filter material.

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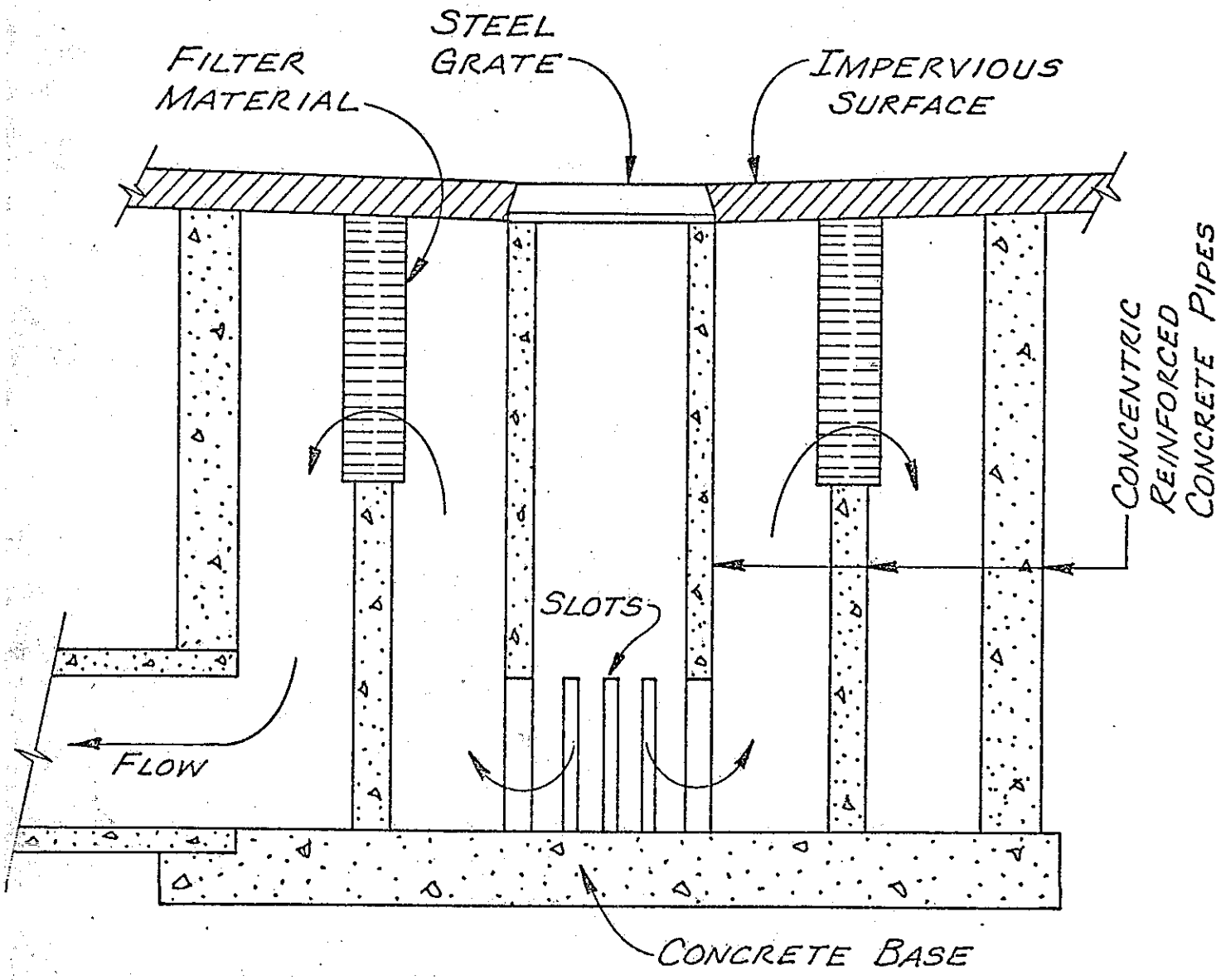

ELEVATION
N.T.S.

FILTER DRAIN

Figure 14

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New Hampshire

°The department has experienced some problems with iron oxide in road cuts. Metamorphic rock is the main source. The iron has collected in bogs and marshes. When it is disturbed, it goes into solution and enters streams and wells. The department either will replace the well or treat. They try to bypass iron-laden water in sensitive areas(14).

°Hay bales have been found to be successful in small flows. Sand filters have also been tried but the hay bales work best.

°For hazardous spills, the state police and maintenance people work together. In some areas, they use a closed detention system consisting of a holding pond with a drain at the bottom.

New Jersey

°Hazardous spills are handled by the maintenance office and State Environmental Bureau.

°The department had two locations where there was sandy material that contained iron pyrites which created a potential acid water situation. The solution was to cover the material with two feet of topsoil. The department now pretests the soil to determine if there will be an acid problem or not. The American Society of Agronomy test procedure is used(15).

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New Mexico

°No information to report.

New York

°Some special situations have been studied where a project was adjacent to municipal water systems for which mitigating measures were successfully applied to reduce the possibilities of pollutants entering the water supplies. Some of the methods used are as follows:

1. A three section sedimentation pond was installed in the stream feeding a small village (Castleton) water system. This pond collected sediment, debris, and floating materials (oils, etc.) from the complete watershed, including a small portion of the highway.

2. Curbs were installed at the edge of the pavement shoulders to collect pavement drainage and discharge it into a flowing stream away from an area of municipal water wells (Rotterdam).

3. An enclosed highway drainage system and a "salt berm" at the toe of embankment were constructed adjacent to a small village reservoir to discharge potential contaminants downstream of the reservoir (Richmondville).

4. Five "ecological" recharge basins are being installed on Long Island to gain aesthetic acceptance from the public and secondarily to trap potential contaminants before reaching the groundwater system (see Figure 15). On Long Island, all runoff has to be discharged into the

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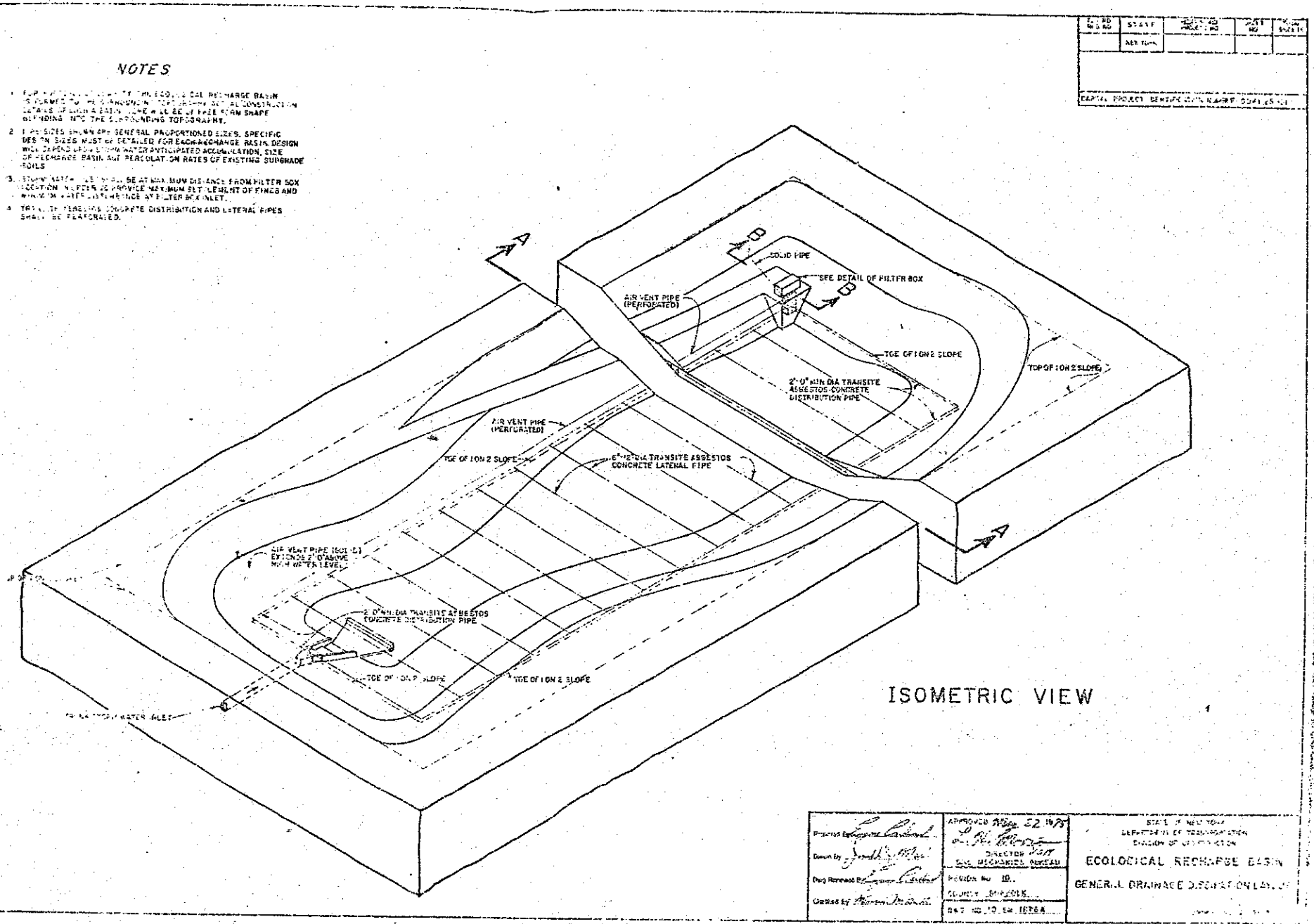

Figure 15

ground to maintain the water table. Since the principal water supply is from wells there is a problem of salt water encroaching from the ocean.

North Carolina

°No methods have been developed to report on at this time. The major effort is aimed at controlling soil erosion.

North Dakota

°No specific mitigation methods have been developed. The main emphasis is in good erosion control practices.

Ohio

°The department has supported studies by the University of Akron to characterize the inorganic composition of highway runoff and compare it to runoff from similar sites unaffected by highway operations. The information from the study is used as a data base for environmental assessments of highway operations(16).

Oklahoma

°The department has construction specifications and standard drawings with regard to pollutant control for construction operations.

°A research project has been initiated to study the effect of runoff on waterways for a specific upcoming highway project.

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Oregon

- The department has extensive procedures for handling erosion control and sediment in water. The Highway Division Environmental Section is closely following research in regard to mitigation of chemical pollutants to identify solutions that may apply to Oregon.

- The department has an oil contingency plan and a hazardous waste spill procedure.

Pennsylvania

- Penn DOT cooperated with FHWA on a study to measure constituents in pavement runoff waters on Route 81 in Harrisburg.

- Penn State University is doing a study on acid and iron pollution abatement associated with pyritic rock in exposed road cuts(17).

- The department has accidental spill guidelines and standard specifications for water pollution control.

Rhode Island

- The department uses typical sedimentation basins (temporary and permanent) to control the silting of ponds, rivers, streams, etc. No other devices are used.

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South Carolina

- No in-depth studies have been performed nor have any particular devices or methods for combatting pollutants been used.

South Dakota

- The department has adopted the AASHTO "Guide for Control and Cleanup of Hazardous Materials". All of the maintenance foremen and supervisors have been trained in handling hazardous materials in accordance with guidelines furnished by Detective Darrel Behrendren of the Denver Police Department and Source of Safety, Inc., Denver, Colorado.

Tennessee

- Region 15 of the FHWA performed a study in 1977 on Tellico-Robbinsville Scenic Highway after notification that acidic drainage from the roadway embankments was draining into McNabb Creek. Alternative corrective solutions were proposed(18).

- FHWA performed a study on identifying constituents in pavement runoff water at Nashville.

Texas

- The department has undertaken a research study on heavy metals, particularly lead, that may be washed off the roadway surface(19).

- The main emphasis has been on erosion control measures.

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Utah

°The FHWA Water Quality Monitoring Workshop was presented to department personnel for training in water quality studies.

°The department is setting up to do project monitoring. Possible projects include I-70 Clear Creek Canyon (Richfield), Provo Canyon and Belt Route in Salt Lake County.

°The work of other states is being reviewed for mitigation measures that are applicable to Utah.

Vermont

°The agency's Standard Specifications for Highway and Bridge Construction spell out, in some detail, the measures required of contractors in avoidance of water pollution during construction. These include a prohibition on discharge of pollutants or conducting refueling, greasing, or batching operations where runoff might result. There is a limitation on the area of erodible slopes which may be exposed and early mulching and seeding of completed slopes is required. Temporary erosion control measures are utilized as required, including dikes, hay dams, settling basins and temporary slope drains.

°In a few instances, protection of water supply sources has required special treatment in construction and maintenance practices. Interstate 89 in Royalton was located uphill from a municipal reservoir. The highway

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was in fill through this location, and the construction included berms at the base of the fill to intercept highway runoff and convey it beyond the reservoir watershed area. This involved an approximate 1000 foot section of the highway.

- Interstate 91 in St. Johnsbury was located through the watershed of a reservoir serving a firm engaged in the manufacture of electrical insulation material. Their manufacturing process required the use of water free from minerals and suspended particulates. During the construction period, a series of hay dams and settling basins were maintained in the 1200 feet between the highway location and the reservoir, and the water entering the reservoir was tested for turbidity on a daily basis.

- In location studies for improvement of US 2 in St. Johnsbury, the proposed new highway routing was along a hillside above a spring serving a roadside water tub. The water tub proved to be something of a local landmark and preservation of the spring developed as a major issue in the project development. After hydrological studies of the spring and its recharge area, and a discussion of measures to protect it from highway runoff, the decision was made to construct the new road downhill from the spring. The supply pipe will be sleeved under the new highway, the tub relocated, and a new parking area constructed adjacent to it.

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Virginia

°Pollutants in pavement runoff waters such as oil and grease, metals and toxic materials as well as hazardous spills, mineral leachates from exposed mineral-bearing soils and materials used in the construction and maintenance of roadways are becoming a major concern to all existing and proposed construction. At the present time, each problem that arises is treated as a separate activity and mitigation measures have become site specific. The department is exploring new techniques for solving these problems and anticipates more insight in the future.

°A study is presently underway to evaluate the effects of heavy metals from highway runoff and a summary report should be completed by 1981.

Washington

°The department has undertaken research studies on the identification of constituents in pavement runoff water completing one study in 1972 and currently conducting a study under contract with the University of Washington(20). The latter study will deal with runoff water quality and methods to prevent or mitigate adverse impacts.

West Virginia

°Grass is planted in drainages to filter pollutants and slow down velocities of runoff water.

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°For hazardous spills, such as petroleum, dirt is mixed with the oil and the material is then taken to an approved disposal site.

°In some cases, the contractor may expose a seam of coal in a road cut. The department may allow the contractor to excavate and sell it if it has an economic value. If it is stockpiled, the material is covered with soil to prevent leaching.

Wisconsin

°The department is monitoring some runoff flows to identify problem areas. In testing some urban runoff, pollution levels have been found to be high for the first few minutes but immediately drop off as flushing occurs. Rainfall patterns seem to provide sufficient dilution water to minimize this problem.

Wyoming

°Best management plans under Section 208 of PL 92-500 are evolving. No problems have been identified yet although this may be of more concern in the future.

°Cofferdams are required around construction work in water.

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APPENDIX

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DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
Office of Transportation Laboratory
P. O. Box 19128
Sacramento, California 95819
(916) 444-4796

Project File #657289

December 6, 1978

The Water Quality Section of the Transportation Laboratory is conducting a Federal Highway Administration HP & R research study on alternative methods of mitigating adverse impacts on water from transportation sources. The research is particularly directed at pollutants in pavement runoff waters such as oil and grease, metals, and toxic materials. Other sources being investigated include hazardous spills, leachates from exposed mineral-bearing soils and materials used in the construction and maintenance of roadways.

We would like to learn more about your methods for mitigating these problems, examples of any techniques or devices you use or have used in the past including good and bad techniques. Any ideas you have that might be applicable for solving any of these problems would also be helpful.

If you have built or use a particular device for mitigating pollutants, we would appreciate knowing the approximate installation and operating cost, maintenance requirements, adaptability to a highway site (any limitations), and the operating energy needs. A sketch or detailed drawing of the device would be appreciated.

As a final request, if you have heard or know about something that you feel might be applicable to our study, please give us the name and address of a reference so that we can follow up on the item.

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You may send your replies to the attention of Richard Howell. In view of your workload, if you feel it would take too long to respond by letter, please feel free to call Mr. Howell at (916) 444-4796 and discuss it with him. Your cooperation is most welcomed and if you would like to receive a copy of the project report at the conclusion of the study, let me know and I will see that you get a copy.

Very truly yours,

NEAL ANDERSEN, P.E.
Chief, Office of Transportation Laboratory

RBH:mn

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